

DECLARATION OF RICHARD G. ALLEN, Ph.D.

I, RICHARD G. ALLEN, Ph.D., declare and state as follows:

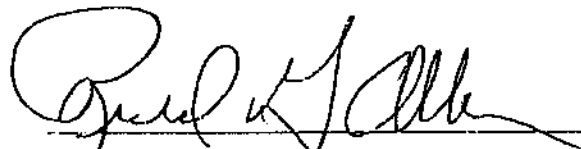
1. I am a consultant in the fields of irrigation engineering, hydrology and water resources engineering with over 25 years experience in irrigation systems design and hydrologic modeling, including calculation, prediction and measurement of evapotranspiration and irrigation water requirements and quantification of irrigation uniformity and efficiency. A current curriculum vitae detailing my qualifications and experience is attached to this declaration.

2. I have been retained by the Metropolitan Water District of Southern California (Metropolitan) to assist it in evaluating the amount of Colorado River water needed to satisfy reasonable and beneficial uses within the Imperial Irrigation District (IID).

3. My opinions, findings and conclusions concerning this matter are summarized below and are discussed in detail in the attached memoranda.

4. The opinions, findings and conclusions detailed in the attached memoranda are based upon my own personal and professional knowledge of and expertise in the matters that are addressed and, if called as a witness, I could and would testify competently thereto.

I declare that the foregoing is true and correct and that this declaration was executed in Twin Falls County, Idaho on May 27, 2003.



RICHARD G. ALLEN, Ph.D.

Consultant to Metropolitan in the areas of
evapotranspiration, irrigation, remote sensing, and
hydrology

RICHARD GLEN ALLEN, Ph.D., P.E.

Water Resources Engineering Professor

DEPT. CIVIL ENGINEERING
and
DEPT. BIOLOGICAL AND AGRICULTURAL ENGINEERING

UNIVERSITY of IDAHO
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May, 2003

AREAS OF SPECIALIZATION:

Hydrology and Water Resources – Surface and Subsurface Systems, Remote Sensing
Evapotranspiration – Prediction, Measurement, Wetlands, Crop Water Requirements
Irrigation – Water Management, Demands, System Design, Soil Water – Flow Processes
Electronic Instrumentation

DEGREES:

B.S. Agricultural Engineering, Iowa State University, November 1974
M.S. Agricultural Engineering, University of Idaho, June 1977
Ph.D. Civil Engineering, University Idaho, May 1984

PROFESSIONAL REGISTRATION:

Civil Engineer, State of Idaho, #4351, July 1981

PROFESSIONAL POSITIONS:

Professor of Civil Engineering and Biological and Agricultural Engineering, December 1998 to Present. University of Idaho.

Professor of Biological and Irrigation Engineering, May 1998 to December 1998.
Utah State University.

Assistant/Associate Professor of Biological and Irrigation Engineering, January 1986 to April 1998. Utah State University.

Assistant Professor of Civil Engineering, January 1984 to December 1985.
Iowa State University, Ames, IA.

Research Associate, May 1977 to December 1983. University of Idaho, Kimberly Research and Extension Center.

PROFESSIONAL CONSULTING:

Irrigation system design and water requirements, water rights, hydrologic systems, hydropower, heat transfer, evapotranspiration, lysimeter measurement of evapotranspiration, software development, remote sensing, expert witness.

SIGNIFICANT PUBLICATIONS:

- 40 Papers in **Refereed Journals/Chapters** - primary author on 20
- 79 Nonrefereed Professional Engineering Papers - primary author on 45
- 19 Technical Research Completion Reports - primary author

Books/Chapters/Edited Proceedings

Evapotranspiration and Irrigation Water Requirements, ASCE Manuals and Reports on Engineering Practice No. 70. M.E. Jensen, R.D. Burman and R.G. Allen. (eds.) 1990. ISBN 0-87262-763-2, 332 p.

Lysimeters for Evapotranspiration and Environmental Measurements, Proceedings ASCE International Symposium on Lysimetry, Honolulu, HA, Allen, R.G., et al., July 23-25, 1991. ISBN 0-87262-813-2, 444 p.

Crop-Water-Simulation Models in Practice. Pereira, L.S., B.J. van den Broek, P. Kabat, and R.G. Allen. (eds.) 1995. Wageningen Press, Wageningen, The Netherlands. ISBN 90-74134-26-2. Hardbound. 339 p.

Chapter 4 "*Evaporation and Transpiration*" in ***ASCE Hydrology Handbook***. New York, NY. Allen, R.G., Pruitt, W.O., Businger, J.A., Fritschen, L.J., Jensen, M.E., and Quinn, F.H., p. 125-252, 1996.

Section 1.5.1 "*Crop Water Requirements*" of the CIGR (International Association of Agricultural Engineers) ***Handbook of Agricultural Engineering***, Vol. I: Land and Water Engineering. L.S. Pereira and R.G. Allen. 1998. p. 213-262.

Crop Evapotranspiration: Guidelines for Computing Crop Water Requirements. United Nations FAO, Irrigation and Drainage Paper 56. Allen, R.G., L.S. Pereira, D. Raes, and M. Smith. 1998. Rome, Italy. 300 p.

Center Pivot Design. R.G. Allen, J. Keller, and D. Martin. 1998, 2000 (rev). Design textbook, Irrigation Association. 303 p.

The ASCE Standardized Reference Evapotranspiration Equation. Report of the Task Committee on Standardization of Reference Evapotranspiration, Environmental and Water Resources Institute of the American Society of Civil Engineers. 2001. Members: I. A. Walter (Chair), R. G. Allen (Vice-chair), R. Elliott, D. Itenfisu, P. Brown, M. E. Jensen, B. Mecham, T. A. Howell, R. Snyder, S. Echling, T. Spofford, M. Hattendorf, D. Martin, R. H. Cuenca, and J. L. Wright. 171 p.

PROFESSIONAL ORGANIZATIONS:

American Society of Civil Engineers:

*Environmental and Water Resources Institute –Chair of the Technical Committee on
Evapotranspiration in Irrigation and Hydrology, Vice-Chair of the Task Committee
on Standardization of Reference Evapotranspiration*

American Society of Agricultural Engineers

International Commission on Irrigation and Drainage

U.S. Representative to the Working Group on Sustainable Crops and Water Use

U.S. Committee on Irrigation and Drainage

Ex-officio Member of the National Board of Directors

American Geophysical Union

Irrigation Association - *Water Management Committee*

National States Geographic Information Council

Honoraries:

Tau Beta Pi

Phi Kappa Phi

Alpha Epsilon

Chi Epsilon

Sigma Xi

Gamma Sigma Delta

PROFESSIONAL AWARDS

Outstanding Journal Paper Award, American Society of Civil Engineers, Journal of Irrigation and Drainage Engineering. 1987. (*A Penman for All Seasons*, R.G.Allen, 1986, 112(4):348-368).

ASCE State-of-the-Art of Civil Engineering Award, American Society of Civil Engineers, 1992

Outstanding Service Award, American Society of Civil Engineers, 1994

Excellence in Teaching Award, Dept. Biological and Irrigation Engineering, Utah State University, 1992

Outstanding Researcher Award, Dept. Biological and Irrigation Engineering, Utah State University, 1996

Excellence in Research Award, College of Engineering, Utah State University, 1996

Outstanding Journal Paper Award, American Society of Civil Engineers, Journal of Irrigation and Drainage Engineering. 1997. (*Assessing Integrity of Weather Data for use in Reference Evapotranspiration Estimation*, R.G. Allen, 1996, 122(2):97-106).

Best Reviewer Award, American Society of Civil Engineers, Journal of Irrigation and Drainage Engineering. 1997

Innovation and Excellence in Teaching Award, Dept. Biological and Irrigation Engineering, Utah State University, 1998

Top Professor Award, Utah State University Mortar Board. 1998

Best Paper Award, American Society of Civil Engineers, Journal of Hydrologic Engineering. 1999. (*Translating Wind Measurements from Weather Stations to Agricultural Crops*, R.G. Allen and J.L. Wright, 1997, 2(1): 26-35).

ASCE 2003 Royce J. Tipton Award, "For outstanding contributions to irrigation engineering through system simulation, software development, teaching, and research and for advancements in the knowledge of evapotranspiration theory and concepts for world-wide application" May 12, 2003.

United States Committee on Irrigation and Drainage 'USCID Service to the Profession Award,' "In Recognition of a distinguished career in water resources engineering and education and for exceptional contributions to the irrigation and drainage profession." May 15, 2003.

INTERNATIONAL EXPERIENCE:

- July - Sept., 1988. **Lahore, Pakistan.** Conducted 3 week training course in Irrigation Scheduling Research. (US-AID ISM/R, Univ. Idaho)
- Nov. - Dec., 1988. Central Soil Salinity Research Institute, **Karnal, India.** Instructed training course in Water Management Research. (FAO/UNDP)
- Nov. - Dec., 1989. **Peshawar, Pakistan.** Conducted a 4 week training course on irrigation principles and design (USAID).
- May - June, 1990. Participation in 12-Member Panel of International Expert Consultants on Crop Water Requirements, UN-FAO, **Rome, Italy**, for revision of FAO publication ID-24.
- March - April, 1991. Central Soil Salinity Research Institute, **Karnal, India.** Designed and installed two precision, electronic weighing lysimeter systems (2m x 2m x 2m) for evapotranspiration research and installed associated weather and data acquisition equipment. (FAO/UNDP).
- May, 1990 & Aug, 1991. **Amman, Jordan.** Irrigation specialist and advisor to Jordan Ministry of Water and Irrigation on National Water Development Plan. (UNDP)
- April - May 1992. **Sana'a, Yemen.** Senior Irrigation Specialist for simulation of groundwater recharge and extraction. (UNDP).
- September, 1993. **Rabat, Morocco.** Review of irrigation research program of Inst. Agronomique et Veterinaire Hassan II. (USAID).
- October, 1994. **Spain.** National Research Program Reviewer, National Irrigation Water Management Program of Spain (Zaragoza, Valencia, Badajoz, Tenerife).
- November, 1994. **Cairo, Egypt.** International Expert Panel on Irrigation Research. (UN-FAO)
- 1995 - 2001. Various consultancy meetings with UN-FAO in Rome, Belgium, Lisbon.
- 1997, 1998, 1999, 2000, 2001. Four day guest lecturer at Institute for Infrastructure, Hydraulics, and Environment, **Delft, Netherlands.**
- April, 1998, April, 1999. Intercomparison Workshop on Evapotranspiration from Remote Sensing. Sponsored by Int. Water Man. Inst., **Menemen, Turkey** and **Wageningen, Netherlands.**
- April-May, 1998. Three week lecturer at Katholic University of Leuven, **Leuven, Belgium.**
- February, 2001. **Amman, Jordan.** Irrigation specialist and advisor to Jordan Ministry of Water and Irrigation on National Water Development Plan. (US-AID)
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INTERNATIONAL EXPERT PANELS and MEETINGS:

- Expert Consultation on Procedures for Revision of FAO Guidelines for Prediction of Crop Water Requirements. Land and Water Development Division, United Nations Food and Agriculture Service, *Rome, Italy*, May, 1990.
- International Expert Panel on Irrigation Research Needs in the Middle East.. UN-FAO, *Cairo, Egypt*, Nov., 1994.
- Expert Meeting on Evaporation and Evapotranspiration Standardization, (U.S. Rep.), World Meteorological Organization, *Vozokany, Slovakia*, May, 1995.
- Advisory Board, DEMETER Remote Sensing Study of the European Union, Albacete, Spain, 2002 – 2005.

PROGRAM REVIEWS:

- October, 1994. **National Irrigation Water Management Program of Spain.** National Research Program Review and Site Visits (Zaragoza, Valencia, Badajoz, Tenerife).
- February, 1999. **National Science Foundation.** Review and Site Visit, Center for Excellence in Hydrology of Arid Lands, Univ. Arizona Dept. Hydrology. Tucson, AZ.
- April, 1998, 1999, 2000, 2002. **Centro de Estudos de Engenharia rural (CEER) (Center for Agricultural Engineering Research).** Instituto Superior de Agronomia, Universidade Técnica de Lisboa. Research Program Review and Site Visits, Lisbon, Portugal.

PROFESSIONAL TASK COMMITTEES:

- ASCE Task Committee on Standardization of Calibration and Usage of Neutron Moisture Profile Gauges. Chair, and Vice-Chair. 1992 – 1998.
- ASCE Task Committee on Evapotranspiration during NonGrowing Periods. Vice Chairman. 1996 – pres.
- ASCE Task Committee on Standardization of Calculations for Reference Evapotranspiration. Secretary. 1999 - pres.

UNIVERSITY COURSES TAUGHT:

- Engineering Hydrology (Iowa State University)
- Water Resources Planning (Iowa State University)
- Water Management (Utah State University)
- Irrigation Engineering Principles (Utah State University)
- Sprinkle and Trickle Design (Utah State University)
- Physical Properties of Biological Materials (Utah State University)
- Modeling Biological Systems (Utah State University)
- Freshman Biological Engineering Seminar (Utah State University)

REFEREED PUBLICATIONS

- Brockway, C.E. and R. G. Allen. 1980. Problems in Developing and Applying an Optimal Irrigation Plan, *J. Water Resources Planning and Management Division*, ASCE, 106(WR1):255-263.
- Allen, R.G., C.E. Brockway, and J. L. Wright. 1983. Weather Station Siting and Consumptive Use Estimates, *J. Water Resources Planning and Management Division*, ASCE, 109(2):134-146.
- Allen, R.G., and C.E. Brockway. 1984. Concepts for Energy-Efficient Irrigation System Design, *J. Irrigation and Drainage Division*, ASCE, 110(2):99-106.
- Allen, R.G. and W.O. Pruitt. 1986. Rational Use of the FAO Blaney-Criddle Formula, *J. Irrigation and Drainage Engineering*, ASCE, 112(2):39-155.
- Allen, R.G. 1986. A Penman for All Seasons, *J. Irrigation and Drainage Engineering*, ASCE, 112(4):348-368.
- Allen, R.G. 1986. Sprinkler Irrigation System Design with Production Functions, *J. Irrigation and Drainage Engineering*, ASCE, 112(4):305-321.
- Allen, R.G., M.E. Jensen, J.L. Wright and R.D. Burman. 1989. Operational Estimates of Reference Evapotranspiration. *Agronomy Journal*, 81:650-662.
- Allen, R.G. and D.K. Fisher. 1990. Low-Cost Electronic Lysimeters. *Trans. ASAE*, Vol 33(6):1823-1833.
- Jensen, M.E., R.D. Burman, R.G. Allen (ed.). 1990. *Evapotranspiration and Irrigation Water Requirements*. Am. Soc. Civ. Engr. Manual No. 70. 332 p.
- Allen, R.G., F.N. Gichuki and C. Rosenzweig. 1991. CO₂-induced Climatic Changes and Irrig. Water Requirements. *J. Wat. Resour. Plan. & Man.* ASCE 117(2):157-178.
- Allen, R.G. and W.O. Pruitt. 1991. FAO-24 Reference Evapotranspiration Factors. *J. Irrigation and Drainage Engineering*, ASCE, 117(5): 758-773.
- Allen, R.G., J. Prueger, and R.W. Hill. 1992. Evapotranspiration from Isolated Stands of Hydrophytes: Cattail and Bulrush. *Trans ASAE* 35(4):1191-1198.
- Scaloppi, E.J. and R.G. Allen. 1993. Hydraulics of Irrigation Laterals: A Comparative Analysis. *J. Irrigation and Drainage Engineering*, ASCE: 119(1):91-115.
- Scaloppi, E.J. and R.G. Allen. 1993. Hydraulics of Center Pivot Laterals. *J. Irrigation and*
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Drainage Engineering, ASCE: 119(3):554-567.

- Allen, R.G., M. Smith, A. Perrier, and L.S. Pereira. 1994. An Update for the Definition of Reference Evapotranspiration. *ICID Bulletin*. 43(2):1-34.
- Allen, R.G., M. Smith, L.S. Pereira and A. Perrier. 1994. An Update for the Calculation of Reference Evapotranspiration. *ICID Bulletin*. 43(2):35-92.
- Walker, W.W., S. Prajamwong, R.G. Allen, and G.P. Merkley. 1995. USU command area decision support model - CADSM. p. 231-272 in Pereira et al., 1995. *Crop Water Simulation Models in Practice*. Wageningen Press., The Netherlands.
- Allen, R.G., Pruitt, W.O., Businger, J.A., Fritschen, L.J, Jensen, M.E., and Quinn, F.H. (1996). "Evaporation and Transpiration." Chapter 4, p. 125-252 in: Wootton et al. (Ed.), *ASCE Handbook of Hydrology*. New York, NY.
- Allen, R.G. 1996. Assessing Integrity of Weather Data for use in Reference Evapotranspiration Estimation. *J. Irrigation and Drainage Engrg.*, ASCE. Vol 122 (2):97-106.
- Hill, R.W. and R.G. Allen. 1996. Simple Irrigation Scheduling Calendars. *J. Irrigation and Drainage Engrg.*, ASCE. Vol 122 (2):107-111.
- Hatfield, J.L. and R.G. Allen. 1996. Evapotranspiration Estimates under Deficient Water Supplies. *J. Irrigation and Drainage Engrg.* ASCE Vol 122(5):301-308.
- Allen, R.G. 1996. Relating the Hazen-Williams and Darcy-Weisbach Friction Loss Equations for Pressurized Irrigation. *Applied Engineering in Agriculture*. ASAE 12(6): 685-693.
- Allen, R.G. and J.L. Wright. 1997. Translating Wind Measurements from Weather Stations to Agricultural Crops. *J. Hydrologic Engineering*, ASCE 2(1): 26-35.
- Allen, R.G. 1997. A Self-Calibrating Method for Estimating Solar Radiation from Air Temperature. *J. Hydrologic Engineering*, ASCE 2(2):56-67.
- Prajamwong, S. G.P. Merkley, and R.G. Allen. 1997. Decision Support Model for Irrigation Water Management. *J. Irrigation and Drainage Engrg.* ASCE Vol 123(2):106-113
- Jensen, D.T., G. H. Hargreaves, B. Temesgen, R. G. Allen. 1997. Computation of ETo under Nonideal Conditions. *J. Irrigation and Drainage Engrg.* ASCE Vol 123(5):394-400.

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- Allen, R.G. and J.L. Wright. 1998. Daytime Albedo of Grass: Methods for Estimation. *J. Irrigation and Drainage Engrg.* (accepted for publication).
- Andrade, C.L.T. and R.G. Allen. 1999. SPRINKMOD – Pressure and Discharge Simulation Model for Pressurized Irrigation Systems: I. Model Development and Description. *Irrigation Science* 18(3): 141-148.
- Andrade, C.L.T., R.D. Wells and R.G. Allen. 1999. SPRINKMOD – Pressure and Discharge Simulation Model for Pressurized Irrigation Systems: II. Case Study. *Irrigation Science* 18(3): 149-156.
- Andrade, C.L.T., R.G. Allen, and R.D. Wells. 1999. SPRINKMOD – Pressure and Discharge Simulation Model for Pressurized Irrigation Systems: III. Sensitivity to Lateral Hydraulic Parameters.. *Irrigation Science* 18(3): 157-161.
- Temesgen, B., R.G. Allen, and D.T. Jensen. 1999. Adjusting Temperature Parameters to Reflect Well-Watered Conditions. *J. Irrigation and Drainage Engrg.* ASCE Vol 125(1):26-33.
- Pereira, L.S., A. Perrier, R.G. Allen, and I. Alves. 1999. Evapotranspiration: Concepts and Future Trends.. *J. Irrigation and Drainage Engrg.* ASCE Vol 125(2):45-51.
- Allen, R.G. 2000. Using the FAO-56 dual crop coefficient method over an irrigated region as part of an evapotranspiration intercomparison study. *J. Hydrology* 229(1-2):27-41.
- Annandale, J.G., N.Z. Jovanovic, N. Benadé and R.G. Allen. 2001. User-friendly software for calculation and missing data error analysis of FAO 56-standardized Penman-Monteith daily reference crop evaporation. *Irrigation Science*. Published on-line at <http://link.springer.de/link/service/journals/00271/>
- Droogers, P. and R.G. Allen. 2002. Estimating reference evapotranspiration under inaccurate data conditions. *Irrigation and Drainage Systems* (16):33-45
- Hargreaves, G.H. and R.G. Allen. 2003. History and evaluation of the Hargreaves evapotranspiration equation. *J. Irrig. and Drain. Engrg.*, ASCE. 129(1):53-63.
- Allen, R.G. 2003. Crop Coefficients. Chapter entry in the Water Encyclopedia. Dekker. 10 p.
- Itenfisu, D. R.L. Elliott, R.G. Allen, I.A. Walter. 2002. Comparison of Reference Evapotranspiration Calculations as a Part of the ASCE Standardization Effort. *J. Irrig. and Drain. Engrg.*, ASCE. accepted for publication.
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Irmak, S., A. Irmak, J. Jones, T.A. Howell, J. Jacobs, R.G. Allen, A. Hoogenboom. 2003. Predicting Daily Net Radiation Using Minimum Climatological Data. J. Irrig. and Drain. Engrg., ASCE. (accepted for publication).

EDITED PROCEEDINGS AND PUBLICATIONS

Allen, R.G., T.A. Howell, W.O. Pruitt, I.A. Walter, and M.E. Jensen. 1991. (Editors). *Lysimeters for Evapotranspiration and Environmental Measurements*, Proceedings ASCE International Symposium on Lysimetry, Honolulu, HA, July 23-25, 1991. ISBN 0-87262-813-2, 444 p.

Allen, R.G. and C.M.U. Neale. 1993. (Editors). *Management of Irrigation and Drainage Systems: Integrated Perspectives*, Proceedings ASCE National Conference on Irrigation and Drainage Engineering. ISBN 0-87262-919-8, 1204 p.

Pereira, L.S., B.J. van den Broek, P. Kabat, and R.G. Allen (ed.). 1995. *Crop-Water-Simulation Models in Practice*. Wageningen Press, Wageningen, The Netherlands. ISBN 90-74134-26-2. Hardbound. 339 p.

TECHNICAL RESEARCH COMPLETION REPORTS

Allen, R.G., C.E. Brockway, and J.R. Busch. 1978. Planning Optimal Irrigation Distribution and Application Systems: Teton Flood Damaged Lands. Research Technical Completion Report, Idaho Water Resources. Research Institute, University Idaho, Moscow, ID, 218 pages.

Allen, R.G. and C. E. Brockway. 1979. Relationship of Costs and Water-use Efficiency for Irrigation Projects in Idaho. Research Technical Completion Report, Idaho Water Resources Institute, Univ. Idaho, Moscow, ID 287 p.

Allen, R.G. 1982. Weather and Consumptive Use at Irrigated and Rangeland Sites in Southern Idaho. Partial Research Technical Completion report, Idaho Water and Energy Resources Research Institute, University Idaho, Moscow, Id, 35 pages.

Allen, R.G. and C. E. Brockway. 1982, Weather and Consumptive Use in the Bear River Basin, Idaho During 1982. Research Completion Report, Idaho Water and Energy Resources Research Institute, University of Idaho, Moscow, ID, 80 pages.

Allen, R.G. and C. E. Brockway. 1983. Estimating Consumptive Irrigation Requirements for Crops in Idaho, Research Technical Completion Report, Idaho Water and Energy Resources Research Institute, University Idaho, Moscow, ID 130 pages.

Allen, R.G. and C. E. Brockway. 1984. Optimizing Irrigation System Design - Summary

Report. Research Technical Completion Report, Idaho Water and Energy Resources Research Institute, Univ. Idaho, Moscow, ID, 39 pages.

- Allen, R.G. and F.N. Gichuki. 1989. Effects of Projected CO₂ - Induced Climatic Changes on Irrigation Water Requirements in the Great Plain States (Texas, Oklahoma, Kansas, and Nebraska). *The potential effects of global climate change on the United States: Appendix C - Agriculture*, Vol.1, EPA-230-05-89-053, J.B. Smith and D.A. Tirpak, eds., U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, Washington, D.C., p 6/1-6/42.
- Hill, R.W. and R.G. Allen. 1989. Crop and Phreatophyte Water Use in Irrigation Systems Management. Research Report, CSRS UTA00804 Project. Utah Agric. Exp. Station, Utah State Univ., Logan, UT
- Smith, M., R.G. Allen, J.L. Monteith, L.S. Pereira, A. Perrier, W.O. Pruitt. 1991. Report on the Expert Consultation on Procedures for Revision of FAO Guidelines for Prediction of Crop Water Requirements. Land and Water Dev. Division, United Nations Food and Agriculture Service, Rome, Italy.
- Allen, R.G., P.J. Vanderkimpen. 1991. Screening and Analysis of Data for Direct Computation of Crop Water Use. Completion Report submitted to USDA-ARS Soil and Water Management Research, Kimberly, Idaho
- Allen, R.G., P.J. Vanderkimpen, J.L. Wright. 1992. Crop Resistance Algorithms for Prediction of Crop Evapotranspiration. Completion Report submitted to USDA-ARS Soil and Water Management Research, Kimberly, Idaho
- Allen, R.G. 1992. Integrated Water Management: Contribution of Groundwater to Crop Water Use. Completion Report, CSRS UTA00804 Project. Utah Agric. Exp. Station, Utah State Univ., Logan, UT
- Allen, R.G. 1993. Evaluation of a Temperature Difference Method for Computing Grass Reference Evapotranspiration. Report submitted to Water Resources Development and Management Service, Land and Water Development Division, United Nations Food and Agriculture Service, Rome, Italy.
- Smith, M., L.S. Pereira, R.G. Allen, P. Steduto. 1994. Final Report on Research Needs in Irrigation in the Middle East. International Expert Panel on Irrigation Research. UN-FAO, Cairo, Egypt.
- Allen, R.G. 1995. Evaluation of Procedures for Estimating Mean Monthly Solar Radiation from Air Temperature. Report submitted to Water Resources Development and Management Service, Land and Water Development Division, United Nations Food

and Agriculture Service, Rome, Italy.

- Allen, R.G. 1995. Standardization of the FAO Penman-Monteith Evapotranspiration Method as a World-Wide Definition. Appendix C, in Report of the WMO Expert Meeting on Evaporation and Evapotranspiration held in Vozokany, Slovakia, 1995, World Meteorological Organization, K. Schulze (ed).
- Allen, R.G. 1995. Evaluation of Procedures for Estimating Grass Reference Evapotranspiration using Air Temperature Data Only. Report submitted to Water Resources Development and Management Service, Land and Water Dev. Division, United Nations Food and Agriculture Service, Rome, Italy.
- Allen, R.G. 1996. Water Requirements of Wetland Communities. Summary submitted to U.S. Bureau of Reclamation, Utah Projects Office, Provo, UT
- Allen, R.G. 1997. Demonstration of Potential for Residential Water Savings using a Soil Moisture Controlled Irrigation Monitor. Project Completion Report submitted to the Water Management and Conservation Activity Department, U.S. Bureau of Reclamation, Provo, Utah.
- Allen, R.G. 1997. Water Use Assessment of the Cibola Valley Irrigation and Drainage District. Draft Final Report submitted to U.S. Bureau of Reclamation, Boulder City, Nevada.
- Allen, R.G. 2000. Summary of M.K. Hansen AM400 and Onset HOBO Datalogger and Watermark Sensor Demonstration and Testing near Twin Falls, Idaho during 2000. Univ. Idaho research completion report submitted to Idaho Department of Water Resources. 15 p.
- Morse, A., M. Tasumi, R.G. Allen, W.J. Kramber. 2000. Application of the SEBAL Methodology for Estimating Consumptive Use of Water and Streamflow Depletion in the Bear River Basin of Idaho through Remote Sensing, Final Report, Phase I, submitted to The Raytheon Systems Company, Earth Observation System Data and Information System Project, by Idaho Department of Water Resources and University of Idaho. 107 pages.
- Morse, A., R.G. Allen, M. Tasumi, W.J. Kramber, J.L. Wright. 2001. Application of the SEBAL Methodology for Estimating Evapotranspiration and Consumptive Use of Water Through Remote Sensing, Part I: Summary Report. Submitted to The Raytheon Systems Company Earth Observation System Data and Information System Project. 45 pages.
- Allen, R.G., M. Tasumi, R. Trezza, J.L. Wright, A. Morse, and W.J. Kramber. 2001.

Application of the SEBAL Methodology for Estimating Evapotranspiration and Consumptive Use of Water Through Remote Sensing, Part II: Details on Validation with Lysimetes and Application to the Eastern Snake River Plain of Idaho. Submitted to The Raytheon Systems Company Earth Observation System Data and Information System Project. 89 pages.

Walter I. A., R.G. Allen, R. Elliott, D. Itenfisu, P. Brown, M.E. Jensen, B. Mecham, T.A. Howell, R. Snyder, S. Eching, T. Spofford, M. Hattendorf, D. Martin, R.H. Cuenca, and J.L. Wright. 2001. rev. 2002. The ASCE Standardized Reference Evapotranspiration Equation. Report of the ASCE-EWRI Task Committee on Standardization of Reference Evapotranspiration. 147 p.

Morse, A., R.G. Allen, M. Tasumi, W.J. Kramber, R. Trezza. 2003. Application of the SEBAL Methodology for Estimating Evapotranspiration and Consumptive Use of Water Through Remote Sensing, Phase III: The Transition to an Operational System. Submitted to The Raytheon Systems Company Earth Observation System Data and Information System Project. 31 pages.

OTHER RESEARCH PUBLICATIONS:

Allen, R.G. 1977. Water Quality Management with Controlled Furrow Irrigation Flow Rates. M.S. Thesis, Dept. Ag. Engineering, Univ. Idaho, 150 pages.

Allen, R.G., J. R. Busch, D. W. Fitzsimmons and G. L. Lewis. 1977. Management of Irrigation Stream Size for Improved Water Quality. ASAE Paper 77-2570. Presented at the 1977 Winter Meeting ASAE, Chicago, IL, 10 pages.

Busch, J.R., R. G. Allen, and C. E. Brockway, October 1978. Irrigation Rehabilitation Plans in the Teton Flood Area. Paper presented at Annual Meeting, ASCE, Chicago, IL, 18 pages.

Brockway, C.E., R.G. Allen, and J. R. Busch. 1979. Optimal Irrigation System Subject to Available Resource Constraints. Paper presented at IX Congress of CIGR, Michigan State University, 11 pages.

Allen, R.G. 1979. Operation and Maintenance Costs and Water-Use Efficiencies of Idaho Irrigation Projects. Paper presented at Pacific Northwest Regional Meeting, ASAE, Boise, ID, 19 pages.

Allen, R.G. and C. E. Brockway. 1983. Operation and Maintenance Costs and Water Use by Idaho Irrigation Projects. Proceedings of the 1983 Specialty Conference, Irrigation and Drainage Division, American Society of Civil Engineers, Jackson Hole, WY, P. 160-174.

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SOFTWARE DEVELOPMENT

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Allen, R.G. 1989-92. CATCH-3D sprinkler catch-can overlap computer model user's manual. Dept. Biol. and Irrig. Engrg, Utah State University, 25 p.

Allen, R.G. 1989, 1991. REF-ET Standard Reference Evapotranspiration computer model user's manual. Dept. Biol. Irrig. Engrg, Utah State University, 40 p.

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Ph.D. Students Supervised as Major Professor

<u>Name</u>	<u>Date of Degree</u>	<u>Dissertation Title</u>
Carlos Hernandez-Yanez	1990	A time-series-based planning model for management of grass and beef production
Paul Vanderkimpen	1991	Estimation of crop evapotranspiration by means of the Penman-Monteith equation
Majid Mirlatifi	1991	Quantification of aerodynamic and canopy resistance terms for estimating reference evapotranspiration
Wigdan Ahmad	1991	Evaporation and transpiration as related to subsurface flow
John Prueger	1992	Evapotranspiration from isolated stands of hydrophytes: cattail and bulrush

Camilo Andrade	1997	Pressure and discharge distribution simulation in pressurized irrigation systems
Daniel Itenfisu	1997	Direct application of resistance-based evapotranspiration methods to row crops
Ricardo Trezza	2002	Evapotranspiration using a satellite-based surface energy balance with standardized ground control
Masahiro Tasumi	2003	Progress in operational estimation of regional evapotranspiration using satellite imagery
Maria Gloria Romero	2003	Daily evapotranspiration estimation from instantaneous values by means of evaporative fraction and reference evapotranspiration fraction

M.S. Students Supervised as Major Professor

<u>Name</u>	<u>Date of Degree</u>	<u>Thesis Title</u>
Mohammed Al-Thamary	1987	Evaluating irrigation uniformity of a side roll sprinkler system under various catch can spacings
Shadab Shadza	1988	Estimation of weather parameters required in evapotranspiration calculations
Hossein Moazami	1988	Infiltration rate and times of ponding under a rainfall sprinkler simulator and double ring infiltrometer
Daniel Segura	1989	Effect of the microenvironment on soil-moisture determination by a neutron moisture meter
Joao Costa	1989	The irrigation design toolbox computer application
Gerald Fernandez	1989	Development of a computer model for diagnostic analysis of sprinkler and pumping systems
Naglaa Eid	1990	Evaluation of the Shany method for estimating the hydraulic properties of soil
D. Ken Fisher	1990	Evaluating performance of electronic weighing lysimeters
Walkyria Gonzalez	1991	Runoff and uniformities under gridded sprinkler systems
Eugenia Molina	1991	Simulation model to predict operating pressures and flow rates for a sprinkler system in operation
Luis Olivarez	1991	Refinement of computer software for hydraulic analysis of sprinkle irrigation systems
Abdulhadi Alghori	1992	Development of insulative covers for surface mounted lysimeter load cells
Bekele Temesgen	1995	Temperature and humidity data correction for calculating reference evapotranspiration at nonreference weather stations
Shrikanth Vemulapali	1996	Wetland evapotranspiration (nonthesis opt.)
Yaseen Al-Mula	1997	Interactive software for design of laterals and tapered manifolds for trickle irrigation systems
Christopher Bright	2001	Evapotranspiration from wetland communities (did not complete)
Patrick Ferrell	2004	Impacts of reservoir level change on landslope stability in the Hagermann National Monument, Idaho
